

ABSTRACT OF THE DISCLOSURE

A method for making a series of nanoscale microstructures, including helical microstructures and cylindrical microstructures. This method includes the steps of: (1) forming a chiral block copolymer containing a plurality of chiral first polymer blocks and a second polymer blocks wherein the chiral first polymer blocks have a volume fraction ranging from 20 to 49%; (2) causing a phase separation in the chiral block copolymer. In a preferred embodiment, the chiral block copolymer is poly(styrene)-poly(L-lactide) (PS-PLLA) chiral block copolymer, and the copolymerization process is a living copolymerization process which includes the following steps: (a) mixing styrene with BPO and 4-OH-TEMPO to form 4-hydroxy-TEMPO-terminated polystyrene; and (2) mixing the 4-hydroxy-TEMPO-terminated polystyrene with $[(\eta_3\text{-EDBP})\text{Li}_2]_2[(\eta_3\text{-}^n\text{Bu})\text{Li}(0.5\text{Et}_2\text{O})]_2$ and L-lactide in an organic solvent preferably CH_2Cl_2 to form the poly(styrene)-poly(L-lactide) chiral block copolymer. Transmission electron microscopy (TEM) and small X-ray scattering (SAXS) studies show that when the volume fraction of poly(L-lactide) is about 35-37%, nanoscale helices with a pitch of 43.8 nanometers and a diameter of 34.4 nanometers were observed.